Iowa Farm Science

Volume 18 | Number 1 Article 6

7-1963

What Can You Do About a Wet Basement?

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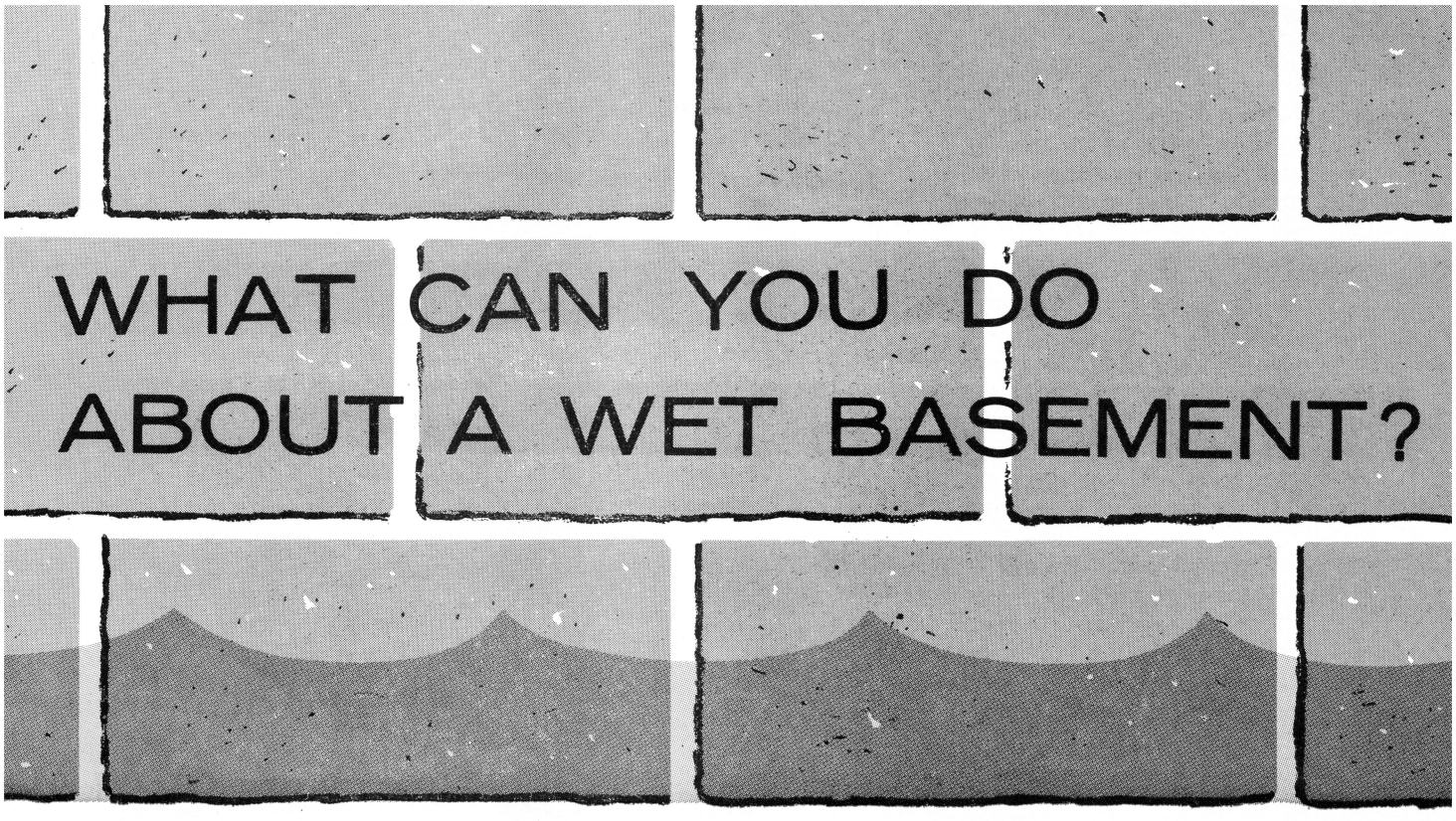

The main solution to the wet basement problem is to provide efficient drainage to remove excess water from the soil around basement walls and to relieve the water pressure that builds up under the basement floor.

by Craig E. Beer, Howard P. Johnson and Fred W. Roth

WET BASEMENTS are a fairly common problem in Iowa. The state's climate and soils almost "encourage" this problem unless adequate and well-designed drainage is provided.

You can enjoy the most use and best appearance of your basement only when its walls and floor are dry and free of cracks. During wet or prolonged rainy periods, water seeps or flows through cracks, and you have a wet basement. Many basement floors crack, in the first place, because of water pressure under the basement floor.

When the soil around basement walls becomes saturated to a height of 3 feet above the basement floor, for example, a pressure of up to 187 pounds per square foot can develop under the floor. This force exceeds that necessary to lift a 6-inch thick nonreinforced concrete slab.

Once the cracks are there, of course, water will seep or flow through the cracks with much less pressure. Then you have a wet basement whenever the soil becomes saturated to a height of only a few inches above the floor.

A Drainage Problem . . .

The main solution to the wet basement problem is to provide drainage to remove excess water from the soil around basement walls and to relieve water pressure under the basement floor. Thus, we're *not* speaking primarily of internal drainage for the basement. The first concern is to keep water out of the basement in the first place. When we speak of drainage in this article, therefore, we refer mainly to *external* drainage – outside the basement walls, around the footings or under the basement floor.

Drainage systems can be built that will effectively do the job of removing excess water around the walls and of relieving water pressure under the floor. The best time to do this is when a house is being built. But, if you already have a house with a wet basement, the job still can be done. First, however, let's consider the wet basement problem in more detail and some of the individual factors that should be considered.

Drainage Planning . . .

Needs Vary: The design and installation of basement drainage facilities depend on several things. If you live in town, there may be municipal restrictions on the outlet of the drainage system. Outletting into the sanitary sewer system may be prohibited and have to be made into the storm sewer system or into a constructed

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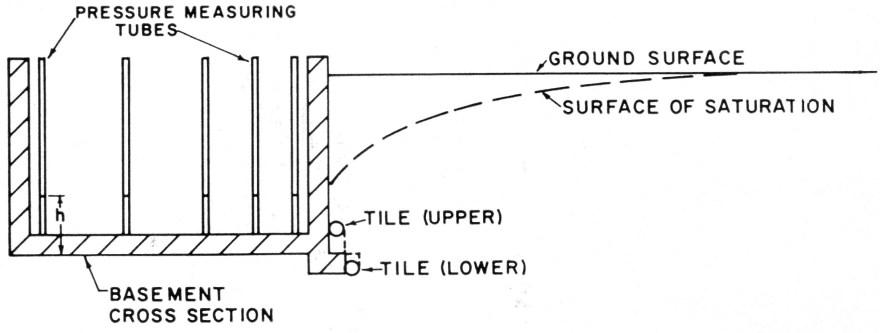
gravity drain. Where no sewer or gravity outlet is available, you may have to collect drainage water in a sump and use a pump to get the water to ground level for surface drainage.

Nature of the soil and drainage system location influence the efficiency of all land drainage. And it's difficult to predict the exact pattern of water drainage from a basement through the soil. There are suggested designs for basement drainage in some home plans, and building contractors gain their own fund of accumulated experience under different conditions. But, when the drainage must depend on movement of the drainage water through the soil, it's helpful to know something of the particular soil's characteristics. This includes knowledge of the approximate rate at which water moves through the soil and the percentage of soil pores or spaces between soil particles that drain freely after the soil has been saturated with water.

The rate at which water moves through soil usually varies with soil depth, and the rate varies considerably among different Iowa soils. The average rates for some Iowa soils are known, however, and can be used with reasonable accuracy in designing basement drainage systems that must depend on movement of the water through the soil. Using this kind of information, we've conducted a number of drainage studies with models — but with materials and methods such that the results are applicable for full-scale installations.

Tile Placement: We tested tile placement in two locations for basement drainage in the model studies (drawing 1). One drainage outlet was even with the basement floor. The other was at a lower level, alongside the foundation footing.

We found that either tile placement satisfactorily reduces the area of saturation outside the basement wall. The usual waterproof coating on the outside of basement walls, combined with either tile placement, should keep basement walls dry. But the wall and area of saturation itself aren't as critical a problem as is water pressure *under* the basement floor.



DRAWING 1. Diagram of tile placement and basement cross section.

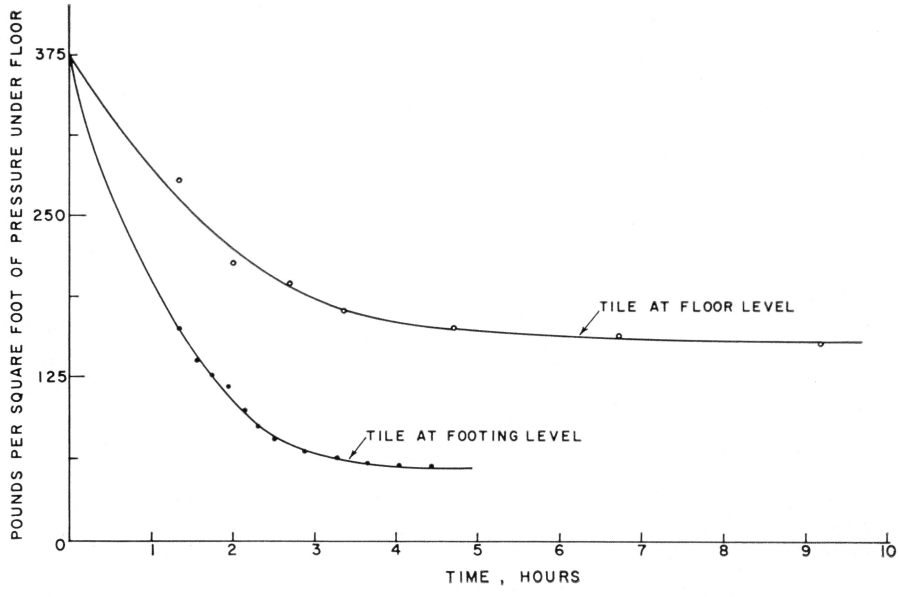
The lower tile placement, we found, is much more effective than the higher tile in reducing water pressure under the basement floor. In our tests, pressure from a very high initial water table was down to a safe level within 5 hours after the water began flowing through the lower tile. The upper tile, however, resulted in a floor pressure that exceeded 129 pounds per square foot 20 hours after the water began to flow. Some pressure remained under the floor 16 days later.

Comparisons of the decrease in pressure in relation to time for the higher and lower tile placements are shown in drawing 2. (The drainage results shown in drawing 2 are representative of the Webster soils in the flat areas of north-central Iowa. We are also making studies to obtain results for other soils with different capacities for water movement.)

The Drainage System . . .

Our model studies have shown that drainage systems can be designed and installed to keep basements dry — even if the house is located over a high water table. The basic elements of an effective drainage system include a satisfactory water collection point and outlet, footing drains outside the basement and drains under the basement floor.

Collection Outlet: To relieve the water pressure under the basement floor, the water drainage collection point and outlet must be below the floor's lowest point — and preferably lower than the bottom surface of the concrete

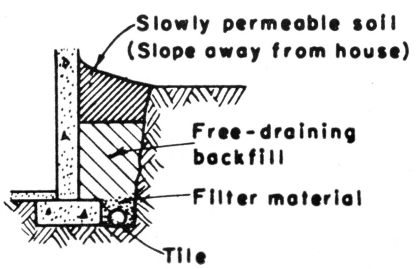


DRAWING 2. Relief of pressure under basement floor for different tile locations.

floor. The collection point usually requires the installation of a sump to collect the drain water and an automatic pump to discharge it.

It may be possible in some basements to install a drainage system that will discharge water to an outlet away from the house by gravity (in town, into a storm sewer, for example). Drainage water shouldn't be discharged into the sanitary sewer system, however, even when permitted. Doing so may overload the system — particularly if water from the eavespouts is discharged into the footing drains. The practice of discharging water from the eaves into the footing drains also is poor unless you keep all trash removed from the eaves and unless the outlet has enough capacity to carry the rain water. (A gallon per minute for each 15 square feet of house area is a reasonable figure for roof runoff from rainfall in Iowa.)

Footing Drains: The most common practice is to place the footing drain tile or pipe next to the outside wall on a level with the top of the footing. For maximum effectiveness and relief of pressure under the floor, however, the tile is best placed outside of the footing and at a level even with or below the footing (see drawing 3).



DRAWING 3.

If more than 5 feet of earth will cover the tile, use tile of higher quality than standard. Tile of 4-inch diameter provides enough drainage capacity for houses if only seepage water is involved and if eavespout drainage isn't discharged directly into the footing drains.

The tile should be surrounded on top and sides by a 3-inch layer of crushed rock or pea-size gravel. If pit-run sand and gravel are used, surround the tile with a porous fiberglass material such as "Tile Guard" before the gravel is spread to keep the smaller sand particles from entering the tile.

Placing a permeable soil (one through which water moves readily) over the gravel or crushed rock filter will help to improve drainage along basement walls. Then, placing a more impermeable soil above this to slightly above ground level will reduce the volume of water that will penetrate to the drain and also will help to divert surface water away from the basement wall.

Floor Drains: Where ground water tables are relatively high, it may also be necessary to include a drainage system under the basement floor itself. This calls for a 5-inch layer of gravel over the entire area immediately under the concrete basement floor. Place lines of drainage tile into the gravel along the inside edge of the footings at about the same level as the footing drains outside the walls. Join the inside and outside footing drains through one opening in each wall of the footing (see drawing 4).

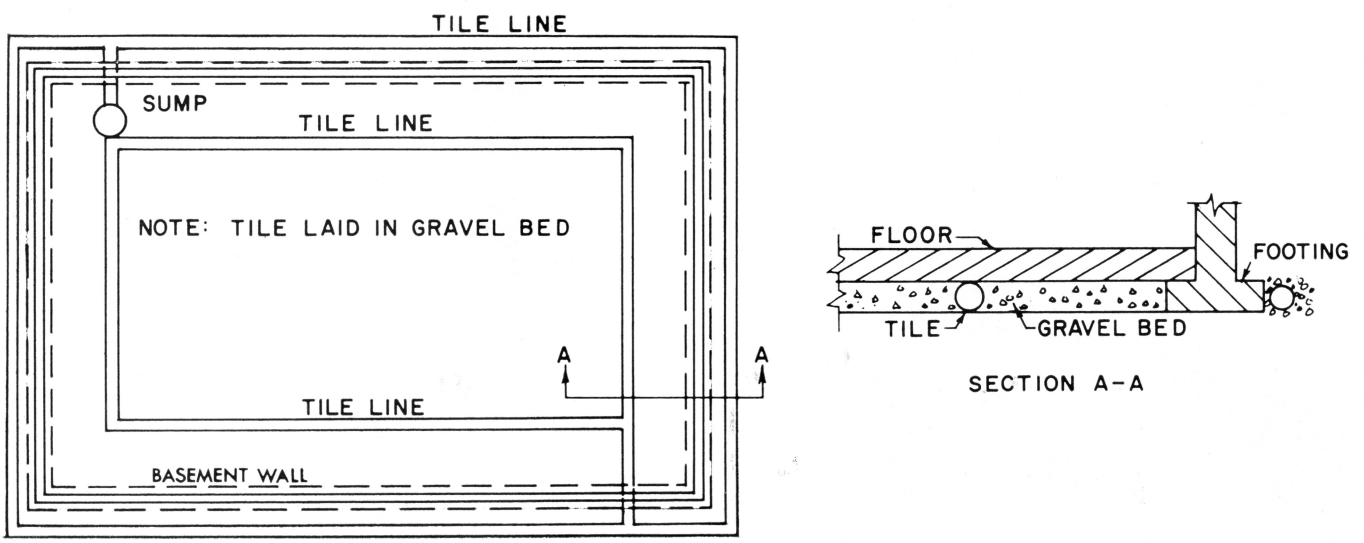
Install all drains so that they slope toward the sump or outlet. Using manufactured tees and corners makes tile installation easier. If your house is located over an artesian water condition, an additional tile line under the center of the basement may be necessary in addition to the lines inside and outside of the edges of the footing.

Cost: The cost of materials and of installing good basement drains is small relative to the total cost of a house — particularly if installed when the basement is built. The tile and filter gravel for installation under the basement floor cost about $75 for a house of about 900 square feet.

The sump, a pump and outside footing drains add about $125. Labor costs vary, but labor for building the drainage system would average about $50. Total cost of the drainage system, if installed when a basement is being built, would average about $250.

Existing House . . .

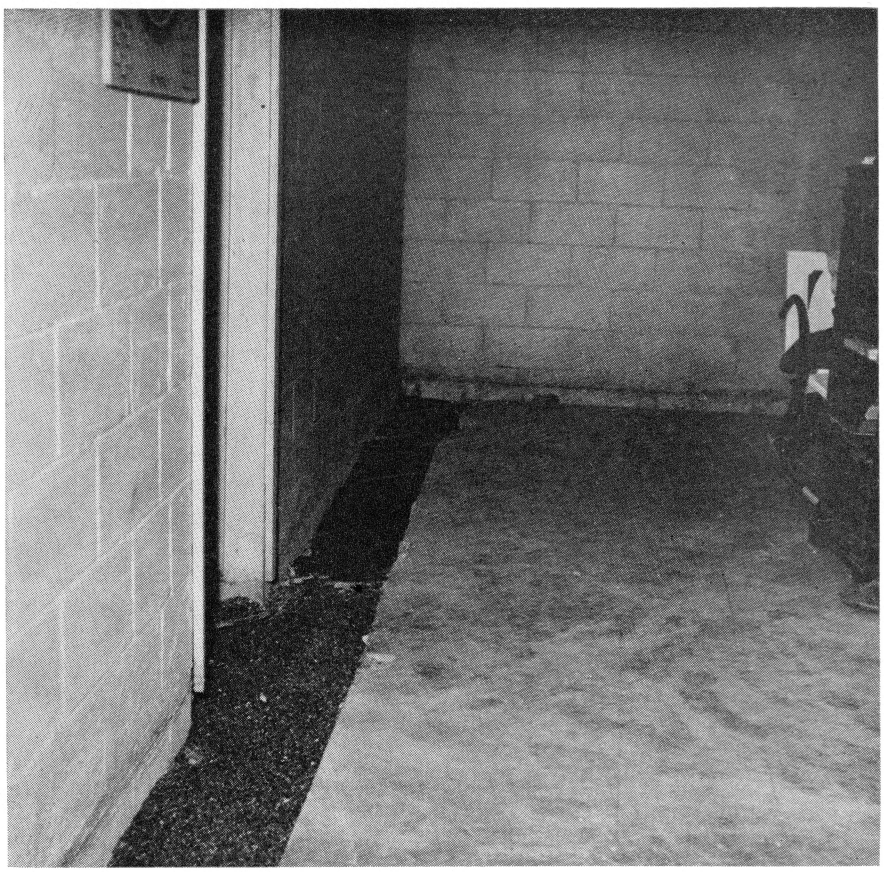
You can still have a dry base-



DRAWING 4. Sketch of basement floor drainage.

ment that will be useful full time even though a good drainage system wasn't installed when the basement of your house was built. It isn't as easy, of course, as if it had been done when the basement was built. But, if your basement is wet because water seeps through the floor, this condition can still be cured by installing a drainage system.

To do this, a strip of basement floor, 12-16 inches wide, must be removed next to the inside foundation wall. The concrete can be broken with an 8- to 12-pound sledge or with a time-saving air hammer. A portable concrete saw to cut through the floor along one or both sides of the concrete strip to be removed will do the job more neatly, quickly and easily.

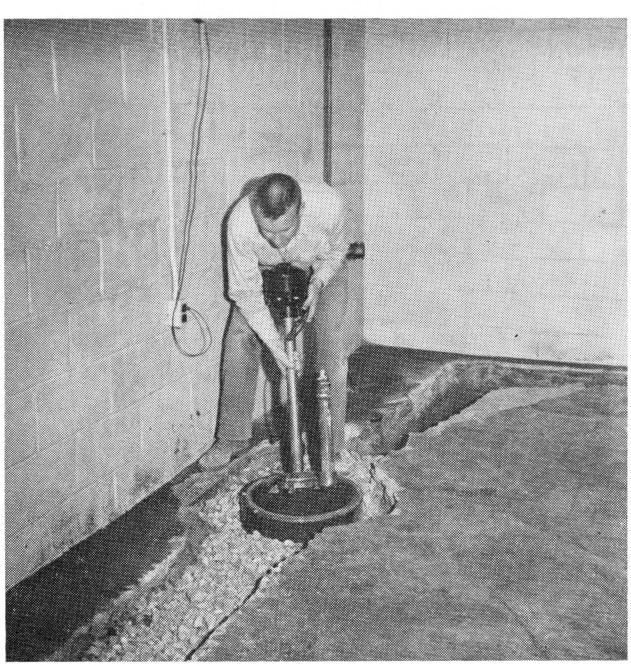


Strip of concrete floor removed along basement wall after making cut with concrete saw. Tile in trench is covered with pea-sized gravel.

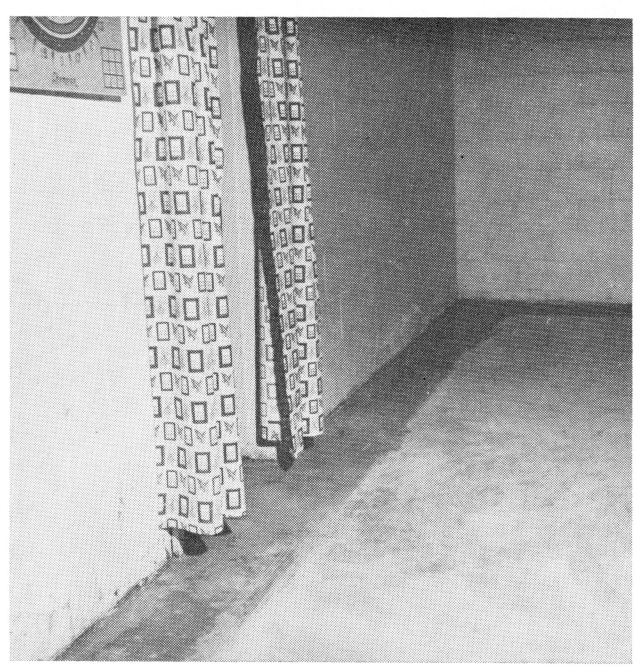
After the concrete is removed, a trench should be made deep enough so that tile can be laid alongside or a little below the footing. The tile itself should be placed in a bed of filter gravel with a uniform slope of 1 inch in 15 feet toward the sump or outlet. For best drainage, avoid having high and low places in the tile line.

A sump probably will be needed to collect the water from the drain tile, and an automatic pump will be needed to discharge the water outside the basement. The sump should be near a corner of the basement or along a wall.

In most cases, these drain tiles installed under the basement floor just inside the foundation walls, at or slightly below the footing level, will drain the saturated soil and, thus, relieve pressure under the basement floor by draining the excess water to a sump or other outlet. Under some extremely wet conditions, additional tile lines under the center of the basement floor may be necessary.



A 16-inch diameter sump collects water from drain tile. Automatic pump empties the sump as water is collected.



New concrete repairs the strip where the basement floor was removed to install the drainage tile and sump pump.